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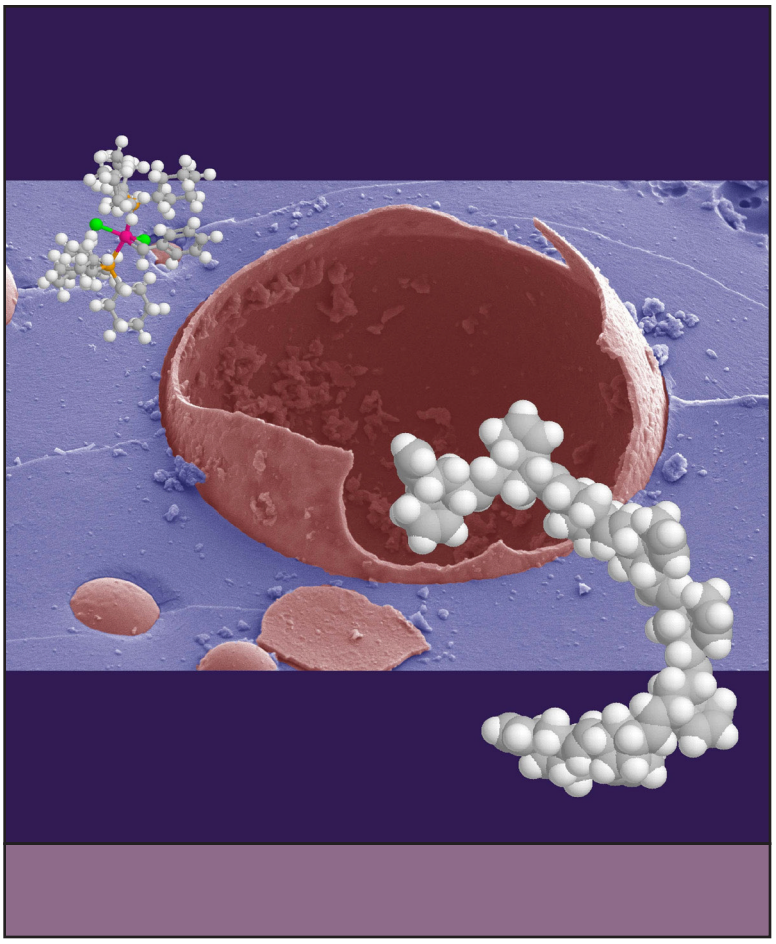
Success Story

AFOSR FUNDS THE DEVELOPMENT OF A SELF-HEALING PLASTIC



Researchers recently reported significant progress in the development of a self-healing plastic. The material could increase the reliability and service life of thermosetting polymers used in a wide variety of applications ranging from microelectronics to aerospace. The payoff of this research to the Air Force (AF) could be significant because of the many polymer-based composites in AF aircraft.

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Accomplishment

Air Force Office of Scientific Research (AFOSR)-sponsored researchers at the University of Illinois at Urbana-Champaign (UI) developed a synthetic material that can heal itself when cracked or broken. The research team, inspired by biological systems in which damage triggers an autonomic healing response, embedded a microencapsulated healing agent and a special catalyst in a structural composite matrix.

Frequently, structural damage in the form of microcracks develops deep within the aircraft where detection is difficult and repair becomes almost impossible. However, with this potential new material, the repair process would begin as soon as a microcrack forms, resulting in more durable aircraft/spacecraft.

Background

Dr. Scott White and his UI team received initial and some follow-on funding from a UI Critical Research Initiatives grant. In 1999, AFOSR's Aerospace and Materials Sciences Directorate awarded the UI research team a three-year grant.

When a material cracks, the microcapsules rupture and release the healing agent into the damaged region through capillary action. As the healing agent contacts the embedded catalyst, polymerization initiation bonds the crack's face closed. Because microcracks are the precursors to structural failure, the ability to heal will enable structures to last longer and require less maintenance.

Filling the microcracks may also mitigate the harmful effects of environmentally assisted degradation such as moisture swelling and corrosion cracking. This technology could increase the lifetime of structural components, perhaps by as much as two or three times. Additionally, the ability to self-repair and restore structural integrity could extend the lifetimes of printed circuit boards where microcracks can lead to both mechanical and electrical failure.

Office of Scientific Research
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Additional information

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